India coastline, 30 per cent of the country's fish production came from the coast of Kerala. There is, however, still ample scope for increasing the output of fish. Only the fringe of the potential for off-shore fishing has been tapped up till now. Similarly, it is believed that the output of fish can also be increased considerably from the coastal fisheries without subjecting the fishing grounds to undue pressure. Introduction of mechanized fishing and better fishing gear can add considerably to fish production. However, as it is, the fishermen are the most depressed class of persons in the economy, and unemployment is at its maximum among them.

1.42 Development of fisheries is of particular importance in case of Kerala in view of the large food deficit of the State. The requirements of rice for a balanced diet could be considerably reduced if it is adequately supplemented by tapioca and fish. Tapioca by itself is not an adequate substitute for rice requirements since it lacks in proteins. However, its food value can be considerably enhanced if it is combined with a sufficient quantity of fish.

*Secondary Sector*

1.43 The secondary sector covers mining and industry. Mining activity is comparatively limited in Kerala in view of the meagre occurrence of minerals. During 1955-56 mining contributed only 0.6 per cent of the State Income (all-India 1%). The chief mineral asset of Kerala is the beach sand. Ilmenite is the most important variety of the beach sands. Besides some fine quality china-clay, of which there are good reserves, other items of mineral wealth of Kerala are not of any particular importance.

1.44 The industries of Kerala, both the factory[1] and the non-factory type, are marked by a low level of productivity as shown by Table 4. The main reason for this is the backwardness of technology employed as would be true of other parts of India as well. While this may not apply to the modern industries run on a large scale basis, in some of which indeed the State has been a pioneer, the overall picture of industry presented as a whole is, nevertheless, one of poor technological level. Further, during 1955-56, the organized factory industries employed 17.5 per cent of the working force in the secondary sector (9.7 lakhs) as against 21.8 per cent in India. Moreover, in both the factory and the non-factory categories, the major share of employment opportunities is monopolized by a few industries which can by no means claim to be in the forefront of modern industries.

1.45 In the non-factory sector, out of a total working force of 7.8 lakh persons, almost 50 per cent of the workers are employed in the coir industry, the foremost industry of Kerala. As in most cottage industries, the maximum degree of mechanization in coir industry never goes beyond a spinning wheel. In Malabar, even that is missing, since spinning operations are mostly carried on with hand. Similarly in the factory sector, the three major industries, viz., cashewnut, textile and coir factories which account for 64 per cent of factory employment, are entirely unmechanized.

1 Factory type of units are defined as those falling within the coverage of Section 2 in (i) and (ii) of the Factories Act, 1948. These include all those factories employing more than 20 workers as well as those employing between 10 to 20 workers, if using power.

## Chapter 6

## Minerals

FROM THE POINT of view of its industrial development, Kerala's mineral resources are a weak link in the State's economy. With a share of only 1.7 per cent in the all-India production of the minerals, Kerala lags behind most other States in the output of minerals. During 1955-56, the net value contributed by the minerals (Rs. 1.95 crores) was 0.6 per cent of the State income against one per cent of country's income.

6.2 The important minerals of the State are beach sands comprising ilmenite, monazite, rutile, sillimanite, zircon, china-clay and tile-clay. Among these ilmenite and china-clay are the most prominent. The reserves of these minerals are adequate to last more than 20 years and may, therefore, be classified as "minerals with adequate reserves". Graphite, iron ore and mica are also found, though only in very small quantities. The deposits of limeshells occur in lakes and along the coast, but are rather modest in content. The metallic minerals and fossil fuels, however, are almost completely absent. It is the deficiency of these minerals which presents an obstacle to the growth of large scale industries.

6.3 Apart from beach sand collection and limeshell winning from the lakes and estuaries, there are eleven workings, all open cast. These do not include tile-clay working about which no data is available. The number of persons engaged in all these 11 mining enterprises (inclusive of beneficiation) is roughly 6,900. However, according to 1951 Census, the number of persons employed in mining as well as in stone-quarrying is about 18,000, i.e., 0.3 per cent of total working force (all-India 0.4%).

6.4 Table 28 gives the output of minerals from the various workings and their value. In 1955, the value of minerals production was Rs. 1.35 crores. Next year, the value of production went upto Rs. 1.95 crores, representing an increase of approximately 37 per cent. This steep rise was mainly due to the increase in ilmenite production, which went upto 314,348 tons in 1956 from 231,585 tons in 1955. Production registered a further increase of about Rs. 20 lakhs during the next year, (that is, 1957), reaching a level of Rs. 2.1 crores. This was maintained during the next two years, that is, 1958 and 1959. In 1960, however, there was a setback as one of the mineral sand companies had since closed down; and it is likely that the value of the output might not have exceeded Rs. 1.3 crores.

[Text continues on p. 92]

[Table 28 appearing on p. 289 of the text, has not been processed -- Analyst]

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## MINERAL RESOURCES: SIZE OF DEPOSITS AND EXTRACTION COST

6.5 In the following pages the importance of the mineral resources, the size of the deposits, costs of extraction—and allied factors, as they affect the industrialization programmes for Kerala, are discussed at some length.

*Ilmenite*

6.6 Foremost among the mineral resources of the State are the beach sand deposits in Quilon district which contain large concentrations of heavy minerals like ilmenite, monazite, rutile, sillimanite and zircon. Some of the ilmenite is of inferior quality due to leucoxenization, particularly along the Neendakara—Azhiyikkal bar.

6.7 The heavy mineral occurrences are of three types:

(*i*) Back beach sand dunes, which form a wasting asset.
(*ii*) Beach washings, which are renewed seasonally during the monsoons.
(*iii*) Sand bar.

In general, the beach washings have a higher content of ilmenite and other heavy minerals than the dunes and the sand bar. The extent of the variations in this respect may be seen in the table below:

| | *Beach washing* (*Per cent*) | *Dunes* (*Per cent*) | *Sand Bar* (*Per cent*) |
|---|---|---|---|
| Ilmenite | 75/78 | 60/70 | 40 |
| Other heavy minerals | 15/20 | 10/25 | — |
| Quartz | around 50 | 10/15 | 60 |

6.8 Of these, the dune deposits are rapidly being used up; and as for the washings, it is not possible to predict the quantities that are likely to be available from time to time. The main reliance for ilmenite has, therefore, to be placed on the sand bar, the total reserves from which are estimated at 34.08 million metric tons.[1] Another estimate places the reserves at 50 million tons. In addition, there are a few minor occurrences in the lake deposits, and in the interior of the country beyond 500 feet of the shoreline.

6.9 At present, however, nearly half the requirements of raw sand come from the washings and the other half from the dunes. The collection of raw sand is done through contractors who supply the sand to the mineral companies. The dune sand is worked manually with a wooden scraper and the pools are very often not backfilled. Beach washings are merely scraped off the beach wherever they accumulate. The cost of the raw sand from these sources works out to nearly Rs. 8 a ton.[2]

[1] *Peaceful Uses of Atomic Energy*, Proceedings of the Second International Conference, Geneva, 1958, p. 106.
[2] *Quartz sand at Pallipuram*—pits mouth value Rs. 1.50 a ton.

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6.10 The present method of working these sands is haphazard and extremely short-sighted. The dunes are getting exhausted while the washings are dependent on a good monsoon. A better method would be to work the sand bar itself. This would also be in the interests of (*i*) conservation and (*ii*) ensuring a regular supply of raw sand independent of the vagaries of nature. Even if working of the sand bar suggested above is not taken up now, back filling of pools with sand tailings from mineral sand companies would prove beneficial. It would lead to building up of sand rich in heavy minerals, other than ilmenite. At present the tailings which contain 80 per cent of the original rutile and all the sillimanite and zircon, are dumped into the sea.

6.11 The extraction of ilmenite is done by the mineral sand companies at Chavara. Till recently there were four units, namely, two units belonging to the Travancore Minerals, one to F.X. Pereira Minerals and one to Hopkins and Williams. These concerns were all under private ownership till 1945. Realizing the strategic importance of these sands, the Travancore State assumed control of the sand deposits during that year ; and the mineral concerns continued to work as agents on behalf of the State. A few years later, however, the Travancore Minerals (1951) and F.X. Pereira Minerals (1956) were taken over by the State Government and run directly as State enterprises.

6.12 Hopkins and Williams, however, continued in private hands till 1959. By this time some difficulties cropped up with labour. The firm had also accumulated vast arrears of royalty to the tune of Rs. 28 lakhs. At this stage the management decided to close down the unit. In the interim period their export contracts had also lapsed. As a result of all these developments, there are two mineral concerns at present operating three units, whose total capacity is 1,60,000 tons. In view of the reduced foreign demand for Indian ilmenite, closure of Hopkins and Williams has not created any serious problem.

6.13 The output per man per shift works out to 0.41 ton at the Travancore Minerals Plant and 0.40 ton in the F.X. Pereira unit ; whereas in the Hopkins and and Williams plant, now closed, the output per man per shift was around one ton. This was partly due to a better layout of the machine. In the existing plants much effort and material is lost in transportation from one unit to another. In addition, excessive labour appears to be employed in the plant of the Travancore Minerals (P) Ltd.

6.14 The production of ilmenite rose from 216,000 tons in 1950, to a peak of 314,000 tons in 1956. Since then it has been fairly steady between 270,000 and 290,000 tons. The value has also been going up from Rs. 33 lakhs in 1950 to Rs. 170 lakhs in 1959. The present price is Rs. 60 per ton.

6.15 Ilmenite is mainly used in the manufacture of $TiO_2$ (titanium) white pigment. $TiO_2$ is used in various other industries like paper, delustrant in rayons, rubber compositions, plastics, printing inks, cosmetics, etc. Titanium metal is not widely used mainly because of its high cost of production.

6.16 Only a very small portion of the production of ilmenite is consumed within the State in the manufacture of $TiO_2$. The Travancore Titanium Products Ltd., Trivandrum, utilize about 3,000 tons of this mineral. This plant is expanding its capacity to 10 tons a day by 1961, and will then require 6,000 tons of ilmenite. The

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rest of the production is exported to various countries, the bulk of it going to the USA and the UK. Export figures are given in Table 29 for the period 1956–59.

6.17 Irregular supplies made through the Koilthottam port, mainly due to labour difficulties, have resulted in the loss of contracts with importers in the USA. Export possibilities of ilmenite are now limited only to two contracts to UK totalling 1,50,000 tons per year. This setback has occurred in spite of the fact that the Chavara ilmenite has a high $TiO_2$ content (55-60%) and is cheaper when compared to Malayan ilmenite (about 45% $TiO_2$) which, however, finds a ready export market.

6.18 India, which at one time used to hold almost a monopolistic position in the export of ilmenite has now to face competition. Side by side with the expansion of titanium industry, other world sources for supply of ilmenite have come into operation as in Norway, Canada, Malaya, Australia, South Africa, etc. Whereas in 1940 India used to contribute 90 per cent to world production of ilmenite, now its share is only 25 per cent.

6.19 In view of the rapid expansion of India's steel industry, the consumption of $TiO_2$ pigment is itself expected to go up. The total requirements of ilmenite by 1965-66 would be 150,000 tons a year for export and 36,000 tons a year for the manufacture of $TiO_2$ pigment, on the basis of proposal for expansion of Titanium Dioxide plant at Trivandrum incorporated in this report. Table 30 gives demand for Titanium Dioxide pigment from steel industry and various other sources. The two existing companies can produce about 160,000 tons a year. Extra capacity of 30,000 tons a year will have to be installed, and this along with certain improvements suggested earlier may require an investment of Rs. 20 lakhs. Very little increase in labour force is envisaged. The existing labour force itself appears to be excessive, since the output per man per shift works out to a low level of 0.4 tons.

6.20 During the Fourth Plan period, steel production is expected to double itself. Therefore, by 1970-71, the demand for Titanium Dioxide may also be expected to be roughly double of the demand in 1965-66. This would necessitate another 30,000 tons of ilmenite per annum. Total requirement of ilmenite by 1970-71 would thus be 220,000 tons a year, comprising of 150,000 tons for export and 60,000 tons for the manufacture of Titanium Dioxide. This would involve further additional outlay of Rs. 10 lakhs. Even this order of expansion can be achieved with the existing labour at an output of one ton per man per shift which would measure a fairly reasonable level of productivity.

*Monazite*

6.21 Monazite is a phosphate of thorium and cerium with rare earth elements and small quantities of Uranium Oxide. It constitutes a source of the radio-active element, thorium being used for atomic energy purposes. Monazite was first discovered in India, by C.W. Von Sohomberg, a German citizen, in 1909 along the beach at Manavalakkurichi.

6.22 Monazite occurs along with other heavy minerals in the beach sands. Reserves of the order of 6.7 million tons are estimated to be present in the bar between Neendakara and Kayarkulam. There is, however, no production of monazite

[Table 30, appearing on p. 290 of the text, has not been processed -- Analyst]

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concentrates from Chavara, the Manavalakkurichi (in Madras State) material being preferred because of its higher thorium content.

6.23 A rare earth factory is located in the State at Alwaye, which processes 1,500 tons of monazite a year ; but it obtains its requirements from Manavalakkurichi in the Madras State. This factory produces Thorium Oxide, rare earth salts and Trisodium Phosphate. The Chavara Monazite may be considered for use in the rare earth factory instead of the monazite from Manavalakkurichi in Madras State, particularly in view of the fact that monazite would be a byproduct of ilmenite which is won in larger quantities in Kerala and may, therefore, prove cheaper.

*Rutile*

6.24 Rutile is another titanium mineral occurring in smaller quantities in the beach sands. The beach washings contain, on an average, about 4 per cent of rutile. A portion of the sand bar at Neendakara is estimated to contain 740,125 tons of the mineral.[1] Kerala is the only State in India producing rutile.

6.25 At present only one of the mineral sand factory units produces this mineral. Electro-static separators are used in concentrating rutile from the non-magnetic tailings after the extraction of ilmenite. Recovery is one-fifth of the rutile content of raw sand and the rest is allowed to go into the tailings for lack of equipment.

6.26 Only small quantities of rutile are produced. During 1959, 482 tons valued at Rs. 4.75 lakhs were beneficiated. The current price is Rs. 1,000 a ton. The mineral is not utilized in the State, but is sent to Bombay and Calcutta for the manufacture of welding rods. During 1957, 155 tons of rutile were imported to meet the requirements of this industry. Future requirements of welding rods within India is estimated to go up from 417 m. ft. in 1960-61 to 2,022 m. ft. in 1970-71.[2] To meet this rise in demand, output of rutile would have to be stepped upto 6,750 tons by 1970-71. An expansion in capacity of this order would require an investment of the order of Rs. 10 lakhs.

*Sillimanite and Zircon*

6.27 Sillimanite as well as zircon occur in small amounts in beach sands in association with ilmenite and other heavy minerals. They average 5.9 per cent and 4.2 per cent respectively of the beach washings. In addition, 1,916,260 tons of sillimanite and 799,350 tons of zircon are estimated to form a part of the Neendakara bar.[3] Only experimental production of either of these minerals has been taken up so far.

6.28 Sillimanite is mainly used in refractories, but the internal requirement of sillimanite refractories is very small. Moreover, the material from Assam which is of a massive variety can be shaped into blocks and used directly. Export possibilities are also dim and due to the development of artificial mulite bricks from domestic kyanite in the USA. Exports have dropped from 20,000 tons to 6,000 tons in 1957.

[1] *Peaceful Uses of Atomic Energy*, Proceedings of the Second International Conference, P. 102.
[2] NCAER estimates.
[3] *Peaceful Uses of Atomic Energy*, Op. Cit, p. 102.

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6.29 Zircon is also commonly used in refractories. The pattern of consumption of zircon is as follows:

| | (Per cent) |
|---|---|
| Refractories | 45 |
| Vitreous enamels | 7 |
| Electrical and chemical industries | 3 |
| Foundry facings | 19 |
| Glass | 1 |

In addition, zircon was considered for use in nuclear reactors. But the great geochemical coherence between zirconium and hafnium makes it unsuitable for this purpose, since their separation is very costly. Niobium is, therefore, replacing zirconium in reactor technology. In view of these factors both zircon and sillimanite do not possess very bright prospects.

*China-Clay*

6.30 China-clay is the principal raw material for the manufacture of china and other porcelains. Apart from this, it finds a number of uses, as for example, in sizings for textiles and as fillers for paper, rubber, linoleum, soap and cosmetics, as well as for pastels, pencils and insecticides. The quality of china-clay found in Kerala especially in Kundara, is claimed to be one of the finest in India. The china-clay occurrences, reported from Changanacheri in the north to beyond Trivandrum in the south, constitute one of the most important horizons in South India.

6.31 According to a survey carried out by the Geological Survey of India, the china-clay deposits in Trivandrum and Quilon districts are extensive. In the Kundara area, it is estimated that one square mile would yield 22 million tons of china-clay. In addition, reserves of the order of 40,000 tons are stated to be available at Murukkampuzha. In the Vanchi clay mines at Chathannoor, the clay horizon has an average thickness of 10-15 feet. The occurrences reported from Ernakulam and Kozhikode districts are either very small or very inferior.

6.32 There were six mines in operation in 1960; one of these, viz., the Kundara clay mines is run by State Government; the others are privately operated. All the mines are open surface workings and mining is by manual labour. With the exception of the working at Kurukkampuzha, all the others have washing plants attached to them. Production of crude china-clay in these concerns during the past few years has been steadily rising as may be seen from the following table:

| Year | Quantity (Metric tons) | Value Rs. |
|---|---|---|
| 1956 | 15,401[a] | 355,000[a] |
| 1957 | 15,378 | 319,000[a] |
| 1958 | 17,047 | 486,000 |
| 1959 | 21,434 | 603,000 |

[a] *Mineral Production in India, 1957*

6.33 The quantity in the Kundara Clay Mines has already been taken to a depth of 35' in the china-clay horizon. Further deepening, it is feared, will only result in material of lower or partly altered basement gneiss being won. However, in view of

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*433 317 the extensive horizontal spread of this horizon, mining operations are capable of considerable lateral expansion.

[655] 6.34 The china-clay from Quilon and Trivandrum districts is mostly consumed within the State by the Government-run ceramic factory at Kundara and the other privately owned ceramic factories, as well as by the rubber, paper, insecticide and [439] cement (for white cement) industries in the State. A few hundred tons are supplied to consumers in the neighbouring States and a small quantity is also (75 tons in 1959 and 44 tons during Jan.—August 1960) exported to Ceylon. The crockery and sanitaryware plants in the State consume about 1,900 tons of refined clay and another 1,700 tons are used by the insecticide, rubber and paper factories in the State. The china-clay produced from Cannanore district is mostly exported to other parts of India.

6.35 It is worth noting here that India imports textile grade china-clay. Import figures for 1956 and 1957 are 7,282 tons and 4,354 tons respectively. The State could very well fill this gap particularly in view of the excellent quality of the material it possesses. Increase in output to meet this demand should be undertaken from the Quilon district, where large reserves are available.

6.36 Demand for china-clay (in terms of crude material)[1] is likely to be as under by 1965-66:

| | (Tons) |
|---|---|
| For ceramics, inclusive of insulators | 9,000 |
| For the rubber, paper and insecticide industries | 10,000 |
| For the textile industry | 15,000 |
| For white cement manufacture | 12,000 |

6.37 During the period 1966–71, china-clay requirements are likely to go up still further as a result of setting up of another high tension insulator factory and increase in demand from the paper, textile and insecticide industries, and are estimated to reach 70,000 tons in terms of unwashed clay by 1970-71. To meet this rise in demand, mining in the public sector at Kundara can be expanded to produce an additional 13,500 tons by 1965-66. This would hardly involve any mechanization. Along with this, the capacity of the washing plant will have to be increased to 30 tons a day. The expansion of mining operations and installation of additional washing capacity proposed would roughly involve a capital outlay of Rs. 5 lakhs.

6.38 Reopening and development of the mines at Chathanoor should also be considered at a rate of exploitation of 22,000 tons of crude clay per year. A washing plant with a capacity of 30 tons a day would be required at this mine. This mine and washing plant may be operated in the private sector. The capital outlay required would be of the order of Rs. 5 lakhs and the mine and washing plant would together provide employment for 310 persons.

6.39 In order to produce an anticipated 70,000 tons per year by 1970-71, representing an increase of 24,000 tons a year over the Third Plan period, a further expansion of mining operations and additional washing capacity of the extent of 20 tons a day will have to be considered either at Kundara or Chathanoor. The additional

[1] Refined china-clay is roughly one-third the weight of crude china-clay.

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investment for this will be about Rs. 5 lakhs and additional employment for 350 persons.

*Graphite*

6.40 This mineral occurs in the form of disseminated grains, stringers and thin veins in surface laterites and the crystalline rocks underneath, mainly charnockitic and associated types. While the disseminated grains occur in charnockitic rocks, the worthwhile occurrences appear to be confined to the area of leptynites.[1]

6.41 Surface occurrences of graphite are known to occur in Kerala at a number of places, viz., Plachikuzhi, Nellimood, Narical, Ozhupara, Karipur, Perumpallimuzhi and Vellanad in Nedumangad taluk, Puliyarakonam and Chenagalloor in Neyyattinkara taluk and in various other isolated localities in Trivandrum district. The occurrences are being investigated geo-physically using electrical methods without appreciable success. This is probably due to the electrical anomalies being marked by the laterite host rock. Perhaps geo-chemical methods may prove more fruitful.

6.42 This mineral was mined in Kerala between 1898 and 1911 by the Morgan Crucible Company, altogether 35,000 tons of material being won. Consequent upon the discovery of graphite in Madagascar, operations ceased in Kerala. The most productive mine was at Vellanad. Recently operations were started at Aukulam on a small scale, but were suspended shortly thereafter. The production has been negligible. The prime need in the near future will be to have a more detailed prospecting on the lines suggested.

*Iron Ore*

6.43 Quartz-magnetite bodies are reported from various localities. In all these cases, the top of these bodies is laterized and often very rich in iron. However, within a few feet the iron content decreases very appreciably.

6.44 The Nanminda occurrence (Pookunnu Hill) is probably the largest one. It would be necessary to explore this area in detail, possibly with core drills before any reasonable conclusion can be drawn. The ore body is steep dipping and will have to be won by underground mining, and further, magnetite concentrate obtained. All this would make the prospect very dear when compared to other iron ore occurrences elsewhere in the country being currently exploited. Further, the possibility of establishing a pig iron plant based either on low-shaft furnaces or electrical furnace techniques, is fraught with difficulties because of the non-availability of coke or lignite and fluxing material within the State.

*Limeshell Deposits*

6.45 Even though no important horizon of limestone is found in the State, limeshell is found to occur in the various backwaters and also in the estuaries of some

[1] I.C. Chacko: *A Sketch of the Geology of Travancore.*

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of the rivers. The best known among these is that of Vembanad lake ; other less important occurrences are in the estuaries of the Kadalundi and Korapuzha rivers, Kozhikode district and Cranganore lake. Only a few of these tracts have been prospected so far. A systematic exploration programme should, therefore, be initiated in all the backwater and estuarine tracts.

6.46 The deposits in Vembanad lake were surveyed by the Travancore Cement Company in 1946. There was no layer of limeshell as such, but it occurred amidst sands and clays, the total thickness of the mixed deposits varying from 1-7 feet. Reserves as estimated then were 3 million tons.

6.47 In addition, in the estuary of the Kadalundi river 400,000 to 500,000 tons of limeshell are estimated to be available in an area of 300 acres.[1] About 100,000 tons of material is also likely to be available from the lower reaches of the rivers Pullut and Thathapally which drain into the Cranganore lake.[2]

6.48 These limeshell deposits provide a raw material of very high purity and which is eminently suitable for use in the chemical industry and in the manufacture of white cement.

6.49 The present production is mainly from Kottayam and Alleppey districts, where the Vembanad lake deposits are exploited. Small quantities are also won from the Kadalundi and Korapuzha estuaries. Details of production available for 1959 are given below:

| *District* | *Quantity* (Metric tons) | *Value* (Rs.) |
|---|---|---|
| Alleppey | 9,098 | 76,542 |
| Kottayam | 86,509 | 696,333 |
| Kozhikode | 500 to 1,000 | N.A. |

6.50 Excepting small quantities sent to the adjoining States from Kozhikode district, the State's output is consumed within the State. The cement company consemus 70,000 tons of shells a year for producing 50,000 to 60,000 tons of grey cement. About 26,000 tons a year are used in lime-burning of which 25,000 tons come from the Vembanad lake.

6.51 Other limeshell utilizing industries which are under active consideration are a sand-lime brick factory at Pallathara with a capacity of 44,000 bricks a day and a calcium carbide factory at Chingavanam with a capacity of 10,000 tons a year. Both these would use shells from Vembanad lake and their annual requirements would be 8,500 tons and 10,000 tons respectively.

6.52 The total annual requirement during 1961--66 would thus be 108,500 tons of shells from the Vembanad lake. In view of the fact that the cement factory has been in existence for the last 11 years and has already consumed about a third of the original reserve of 3 million tons, proposals for new limeshell-based industries in the same area introduce problems regarding assured reserves of raw materials and their conservation.

[1] *Administration Report of the Geological Department*, Government of Kerala, 1958-59, pp. 3-4.
[2] Ibid pp. 3-4.

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6.53 First, possibilities of an alternative source, e.g., shells from the sea, should be assessed quantitatively, which could possibly meet requirements of the local lime-burning units. This would relieve the pressure on the lake and estuarine deposits, which could then be conserved for larger industrial units.

6.54 Secondly, new industries could perhaps be located near other known shell deposits. A case in point here is the Calcium Carbide Factory requiring about 10,000 tons annually, which could be located in the Kadalundi area where reserves of the order of 400,000 to 500,000 tons are available. In this location the unit would be assured of its shell requirements for the next 40 to 50 years on the basis of an average annual requirement of 10,000 tons, whereas in the Vembanad lake location, reserves would last only for 15 to 20 years.

6.55 The requirements of the sand-lime brick factory, however, are only about 3,500 tons a year and it should be possible to accommodate this requirement from the present consumption of 25,000 tons by the lime-burning industry.

6.66 In this context, it would be relevant to mention that in absolute terms, the accretion of shells is rather small; and in terms of the proposed rate of exploitation this accretion is even negligible. Further, the proposal to construct a bar across the mouth of the Vembanad lake would change the salinity of the water and would very likely put an end even to this small accretion. As to whether the shell organism could be simulated to thrive on a large scale is a problem for long term research.

6.57 In the meantime, in view of the rapid depletion of reserves in the Vembanad lake, strict control should be exercised over the exploitation of this deposit with periodical inspection to check unauthorized collection. The rate of exploitation may be kept at the present level but should not be allowed to rise.

*Mica*

6.58 Two varieties of mica, muscovite and phlogopite are known to occur in the State. Muscovite is reported from Kulikhoor, and Sholayaramson from Palghat district and phlogopite from Punalur in Quilon district. However data relating to reserves are not available for any of these deposits.

6.59 At Kulikoor in Palghat district, a few prospecting pits have been put down which exposed a small vein of ruby mica with very little strains. The presence of ruby mica on a fairly large scale along the same belt in the adjoining State may be taken as a favourable indication. Further prospecting should be undertaken in the area.

6.60 Production from the only mine in the State at Punalur has been intermittent. Figures for production since 1957 when mining activity was revived are given below:

| Year | Quantity (Metric tons) | Value (Rs.) |
|---|---|---|
| 1957 | 72 | 40,000 |
| 1958 | 72 | 40,000 |
| 1959 | 46 | 23,000 |

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6.61 Formerly mica used to be exported from this mine, but now because of its inferior grade and development of cheaper substitutes, the market has ceased to exist. Production has been giving demand and the mine is again on the verge of closing down.

*Quartz-Sand*

6.62 An extensive deposit of quartz-sand occurs along the Shertallai-Pattanakad-Pallipuram-Panavally area. Reserves of the order of 80 million tons are said to exist here. However, all the sand is not glass grade, being gritty in large portions.

6.63 There are two workings in Shertallai taluk, one at Pallipuram and the other at Panavally. Mining is selective in that only such areas which contain finer material are worked. The workings are not mechanized. The raw sand is sieved and winnowed at the workings. Further sieving is done at the glass factory, the final recovery standing at 50 per cent of the original, and represents the portion between 30 and 80 mesh screens.

6.64 About 3,000 tons sand is produced annually with a pits-mouth-value of Rs. 1.50 a ton. A major portion of the output is consumed by the glass factory at Alwaye, while the rest is supplied to silicate factories in the State and consumers outside the State.

6.65 A sand-lime brick factory is coming up at Pallathara in the public sector with an installed capacity of 44,000 bricks a day and it will be a major consumer of quartz-sand. Its sand requirements would be 33,750 tons a year. The total raw sand requirements by 1965-66 would be 46,000 tons a year. Exploitation at this rate would require an investment of Rs. 2 lakhs. By 1970-71, the sand requirements would further increase to 90,000 tons a year requiring an additional investment of Rs. 15 lakhs. At the same time, an integrated scheme to work the sands systematically and utilize both the coarse and fine grades should be undertaken, rather than leaving the sand collection to contractors.

*Salt*

6.66 Salt, besides being an essential ingredient of food, also serves as a basic raw material for the manufacture of alkalies. It is commonly extracted from sea water by solar evaporation. Production of salt in Kerala during the last few years has been as follows :

| Year | Quantity (Metric tons) | Value (Rs.) |
|---|---|---|
| 1955 | 36,094 | 1,180,000 |
| 1956 | 783 | 10,000 |
| 1957 | 336 | 5,000 |
| 1958 | 708 | 10,000 |
| 1959 | 1,007 | 13,000 |

11: India G-4, 5 (1960-1961) 1962 AW11 Kerala AW11



6.67 In the erstwhile State of Travancore-Cochin, there were 14 centres of production around Cape Comorin and one at Malipuram, Vyppeen Island, Ernakulam district. Consequent upon reorganization of the States, there is only one salt work in Kerala today. This is reflected in the sudden drop in production to a few hundred tons of salt between 1955 and 1956.

6.68 The prime requisite for the manufacture of salt by the solar evaporation method is a dry climate with accompanying low humidity. Such a condition is rarely obtained anywhere in the State. The result is that the yield of salt is very low with the cost of production at 75 nP. to a rupee per maund (in Tuticorin—cost of production is 25 nP.). In view of the unfavourable climatic conditions, this industry does not appear to have much prospects in the State.

*Tile-Clay*

6.69 Tile-clay is the raw material for one of the major industries of Kerala viz., the tile industry. More than 150 tile factories operate in the State, providing employment to over 10,000 workers. Tiles produced are sent to other parts of India as well as to markets in some of the Far Eastern countries. The exports are mainly from the Feroke area.

6.70 Local earths, silts and clays are found along the alluvial flats of most of the rivers of the State. Clay collection is seasonal and is undertaken through contractors. It provides employment to about 3,500 people. Collection is done manually and the clay is transported by countrycrafts along the waterways, or by roads, where water transport facilities are not available. Depending on the distance of transportation, the price of clay varies from Rs. 2 to Rs. 5 per ton at the factory.

6.71 In 1865, the 'Basel German Industrialists' started the first tile factory in the country at Mangalore with the object of securing the Far East Market, which was until then being supplied by the French tile industry in Marseilles. The industry then spread rapidly, first to Feroke near Kozhikode and later on to Quilon and other areas, until today, Kerala can well claim to be the home of the tile industry in the country.

6.72 Production of tile-clay in the State during the last few years is given in Table 31.[1]

6.73 As can be observed, there has been a declining trend in tile production. The main part of the decrease has taken place in the major tile producing areas of Trichur and Quilon,

6.74 The decline in output of tiles is due to a shrinkage in the foreign markets. On the other hand, an optimum area for distribution within the internal market is a belt of 400 miles from the coast. In view of the near saturation point which Kerala's tile industry has reached, prospects for increased production of tile-clay are rather bleak.

*Other Minerals*

6.75 *Gold* : Occurrences of gold in Wynaad and Nilambur area have been known since the late nineteenth century. The discovery of old workings led to the

[1] [Table 31, appearing on p. 291 of the text, has not been processed -- Analyst]

11: India G-4, 5 (1960-1961) 1962 AW11 Kerala AW11



*433 316 formation of a large number of companies which together won 600 ozs. of metal. During the last war, operations were again commenced but mainly for pyrite, which were also given up.

6.76 It is obvious that all surface occurrences have been worked out. However, prospecting for hidden lodes could still be carried out. A preliminary survey by panning up the stream to the heads of the tributaries in search of mother lodes is indicated.

135 6.77 *Lignite*: A lignite occurrence two feet to eight feet thick exposed on the beach at Varkalai had been reported, but it has proved to be abortive on drilling.

6.78 *Semi-Precious Stones*: The presence of semi-precious stones like cats' eye, amethyst, and iolite are reported from various places in Nedumangad taluk, Thiruvalla and Kollengode, but none has proved worthwhile. Recently beryl has also been reported from mica bearing area at Kulikkoor in Palghat district.

6.79 *Kankar*: In the black cotton soil tracts of Kozhinjampara and Chittur firkas in Palghat district kankar limestone is met with and is used locally in lime burning.

6.80 *Gypsum* : It is known to occur in similar soils in the Coimbatore district of Madras State. An intensive search may, therefore, be made in these black cotton soil areas for this mineral.

## CONCLUSIONS

*433 135 6.81 Mineral resources play a vital role in the economic development of any region. The process of industrial development generally involves a shift from industries based on primary raw materials like agricultural or forest produce to more technologically advanced industries using a higher content of metallic minerals. Kerala is unfortunately placed in this respect as its mineral resources are marked by absence of any of these basic minerals, namely, coal, iron and copper.

*433 317 6.82 Some of Kerala's industries, however, do have good prospects. Beach sands, the chief mineral assets of Kerala, are the source of titanium bearing ilmenite. Although possibilities of increase in export of this sand are not bright, internal demand for ilmenite from the Titanium Dioxide industry is expected to rise substantially. Similarly, extensive deposits of quartz sand and fine quality china-clay occur in the State. This report envisages a considerable expansion in demand for both of these from existing industries as well as from new factories suggested for production of high tension insulators, sand-lime bricks, etc. In contrast to these three, the other minerals have only limited potentials of development. Thus monazite which contains the radioactive element thorium is available in quantity but has a restricted demand at present. On the other hand, the known reserves of limeshell are in short supply and do not offer scope for expansion of the cement industry based on it.

[138] 6.83 Among the rest, iron ores are not capable of being developed for lack of coal while mica and graphite would depend entirely on future discoveries.

6.84 On the whole, an increase in mineral production from a value of Rs. 130 lakhs in 1961 to Rs. 197 lakhs by 1965-66 and Rs. 250 lakhs by 1970-71 is envisaged here. Between 1956 and 1961 there was, however, a fall in the value of output from

11: India G-4, 5 (1960-1961) 1962 AWll Kerala AWll



Rs. 200 lakhs to Rs. 130 lakhs mainly due to the loss of export market for ilmenite, in the USA. 433* 317

6.85 An increase in the minerals output between 1961–71 of the above order is estimated to require an investment of Rs. 56 lakhs during 1961–66 and Rs. 35 lakhs during 1966–71. Additional employment, however, is expected to increase only by about 2,000, that is, from 7,000 to 9,000 persons. The existing labour employed in ilmenite concerns is rather excessive, and it is considered that output of ilmenite can be raised without much extra labour. These results are summarized in Table 32.

[Table 32, appearing on p. 291 of the text, has not been processed – Analyst]